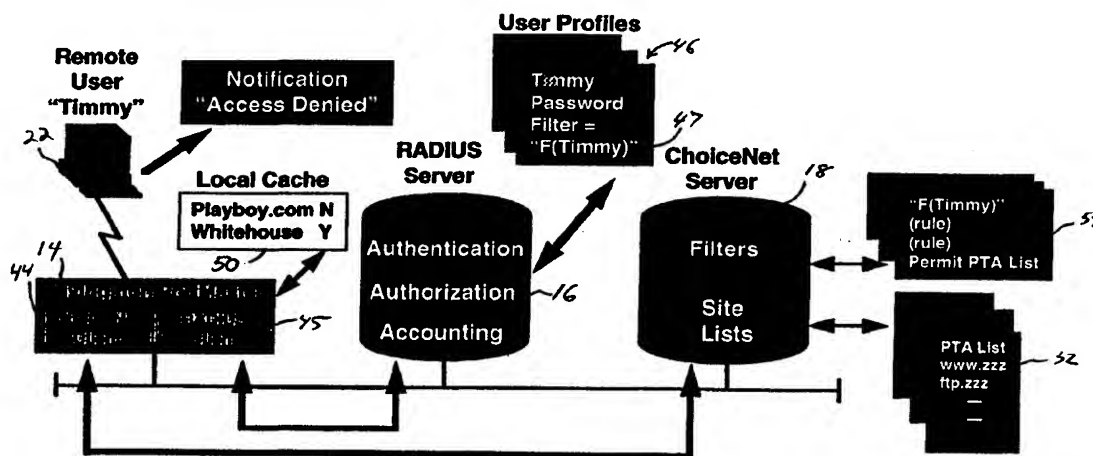




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: NETWORK ACCESS CONTROL SYSTEM AND PROCESS



## (57) Abstract

An Internet access system (10) incorporates an access control subsystem (12), implemented with a communications server (14), one or more Remote Authentication Dial In user Service (RADIUS) servers (16), and a remote access server (18) in a network (21).

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## NETWORK ACCESS CONTROL SYSTEM AND PROCESS

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention:

5       The present invention relates generally to a centralized, server, based approach to Internet and similar computer network of networks content monitoring and user authorization. More particularly, it relates to a system and process which uses dynamically down-loadable user specific filters from a central server for content monitoring and user authorization in a network of  
10 networks.

#### 2. Description of the Prior Art:

      Much press has been made in recent months over public desire for restricting access to indecent text and graphics on the Internet. Parents and schools have raised legitimate concerns about the ease with which children can  
15 gain exposure to pornographic, violent, racist and other indecent materials, especially in graphical forms found on the fast expanding World Wide Web (WWW). Most recently, the Telecommunications Reform Act signed by President Clinton legislates Internet censorship and stiff punitive measures to enforce these desires. However, most users and advocates of the Internet agree  
20 that such government regulation is not the answer. The upshot of this groundswell has been the overnight development of a marketplace for products that empower parents, schools and corporations to choose the Internet content that children, students and employees experience. Proposals for voluntary ratings on Internet sites are also in progress and are being actively added to  
25 legislation.

      While first generation Internet content monitoring products represent a good first step, they only offer a partial answer, and one that has many shortcomings. The first generation of Internet content monitoring products arose from existing technology which monitored the use of local software on a PC for  
30 indecent or violent content based on keyword lists. These products were extended to monitor hostnames, URLs and other Internet content that appeared on the PC using these keyword lists. For example, the keyword lists commonly distributed with these products include general words like "erotic", "sex" and

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“xxx”, and sometimes specific hostnames, like “playboy.com”. The principle behind these lists is to deny access to sites, URLs, or any document that contains these keywords. So, if the user of the PC typed “playboy.com” in his browser screen to go to that site, the software would actively deny access and stop the  
5 browser from going to that site, or at least log the instances of keyword violations for later review by an authorized administrator, such as a parent or teacher.

There are a number of reasons why this approach is ill suited to the Internet.

10 *1. Deny keyword lists lag behind the growth of the Internet.*

The Internet is growing too fast and is too smart to be bottled up by keyword lists. To begin with, updates of keyword lists lag behind the actual creation and appearance of “bad” sites on the World Wide Web. Some products only update their lists once a month as part of a subscription service. Most don’t allow  
15 parents and teachers to customize the lists themselves. Others don’t provide any update service at all. All of these factors mean that there will be large holes in the protective screen that these products intend to cast over Internet content.

*2. “Bad” words must be used to be caught by deny keyword lists.*

Denial of service keyword lists depend on the use of “obscene” language at  
20 Internet sites in order to screen them. Once the creators of Internet sites catch on to this, more and more “obscene” sites will use “innocent” words to thwart the keywords, thus diminishing the efficiency of deny keywords lists steadily over time. An example would be the site called [www.candyland.com](http://www.candyland.com). Although it has a neutral name, it is an adult site. A keyword list could not catch and deny  
25 all of these sites without denying thousands of innocent sites by extension.

*3. No restrictions on indexes and search engines.*

Deny-based approaches do not restrict the index and search tools that users access. Ironically, one of the most powerful tools for breaking through the protective screen of deny-based monitors are the very indexes and search tools  
30 that practically all Internet surfers use for free to find information on the World Wide Web. These indexes can search all the available sites, both the good and the bad, so it is very easy to find indecent sites that do not get denied by the keyword lists.

*4. PC-based content monitors can be easily tampered with.*

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Most children who use the Internet are far more sophisticated users than the parents and teachers who are trying to restrict their access to questionable content on the Internet. It is possible that children will be able to hack around a PC-based solution without a parent's or teacher's knowledge.

5           5. *Distributed PC-based content monitors are administratively cumbersome.*

For parents to use these products effectively, there must be constant monitoring, either to find new sites that are not being caught by current keywords or to send in requests to the software manufacturer for additions to the deny list. Internet  
10   marketing studies show that the typical parents who provide Internet access to their children are in a demographic that is already challenged for time by career pressures. It is unlikely that these parents will have the time, expertise or energy to learn to maintain and monitor their child's home PC. This administrative overhead is worse for schools that are considering implementing these solutions  
15   on every PC and Macintosh in a school district.

6. *Distributed PC-based content monitors require a PC.*

The new generation of Internet terminals, which have no hard disk to store programs, will not be able to run this type of client software and retrieve list updates.

## SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide a system and process for network access control that allows customized Internet content monitoring based on a centralized permit model.

25           It is another object of the invention to provide such a system and process which is readily implemented using hardware that is typically present in most installations for Internet access.

It is a further object of the invention to provide such a system and process that utilizes an extension of firewall filtering to implement the content  
30   monitoring.

The attainment of these and related objects may be achieved through use of the novel network access control system and process herein disclosed. A network access control system in accordance with this invention has a local access server with a local cache for storage of recently used user filters and sites  
35   accessible from the system for which access has been requested. A network

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access server is coupled to the local access server and has storage for user filters. Access client software resident in the local access server uses the user filters and sites for which access has been requested in the local cache for making an access determination for a site to which a user requests access and communicates with the network access server to obtain an access determination from the user filters and site lists stored at the network access server if an access determination cannot be made from the user filters and sites stored in the local cache.

In another aspect of the invention, a process controls network access in a system of interconnected networks by defining user access filters for determining if a request by a user for access to a desired site in the system should be permitted. Recently used user access filters and sites accessible from the system for which access has been requested are stored in a local cache of a local access server. User filters and site lists are stored at a network access server coupled to the local access server. An attempt is made to use the user filters and sites for which access has been requested in the local cache for making an access determination for a site to which a user requests access. At least one of the user filters and site lists stored at said network access server is used to obtain an access determination if an access determination cannot be made from the user filters and sites stored in said local cache. In a further aspect of the invention, a storage medium has stored therein a program, which when executed on a networked data processing system, will carry out the above process.

The attainment of the foregoing and related objects, advantages and features of the invention should be more readily apparent to those skilled in the art, after review of the following more detailed description of the invention, taken together with the drawings, in which:

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of an Internet access system employing the invention.

Figure 2 is a block diagram of a first portion of the system shown in Figure 1.

Figure 3 is a more detailed block diagram of a second portion of the system shown in Figure 1.

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Figure 4 is a block diagram of a second embodiment of an Internet access system employing the invention.

5 Figure 5 is a block diagram of a third embodiment of an Internet access system employing the invention.

### DETAILED DESCRIPTION OF THE INVENTION

Turning now to the drawings, more particularly to Figure 1, there is shown an Internet access system 10 which incorporates an access control  
10 subsystem 12 of this invention. The access control subsystem 12 is implemented with a communications server 14, one or more Remote Authentication Dial In User Service (RADIUS) servers 16, and a remote access server 18, all connected to a network backbone 20. In the network 21 connected  
15 by backbone 20, users are connected to the network by dial-up connections 22 through the communications server 14 or via a local area network (LAN) router 24, also through the communications server 14.

The network 21 connected to backbone 20 is connected to the Internet or other public/private network 26 through a firewall router 28. A World Wide Web (WWW) and File Transmission Protocol (FTP) server 30 for the network  
20 connected by backbone 20 is also separately connected to the Internet 26 through the firewall router 28 for security of the rest of network 21 from outsiders accessing the web and ftp sites of the network 21. Various other heterogenous sites 32, 34 and 36 are also connected to the Internet 26. In addition to serving  
25 as part of the access control subsystem 12 for the network 21, the access control server 18 also serves as a central access control server for the other sites 32, 34 and 36 shown in Figure 1, as will be explained in further detail below. By way of example, the network 21 might represent an Internet Service Provider (ISP).

As represented in Figure 2, the access control subsystem 12 incorporates integrated software modules 38, 40 and 42, respectively comprising the  
30 RADIUS module, the network access module, and the firewall filtering module in security systems software 43. Because the network access module 40 works with the RADIUS module 38 and the firewall filtering module 42, the network access system and process of this invention can be implemented with hardware resources otherwise present on a network. Although the remote access server 18  
35 is shown as part of the network 21, many sites 32, 34 and 36 utilizing it in the

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system and process of this invention will access it remotely through the Internet 26. Alternatively, the routers 24, 32, 34 can be part of networks having their own network access server 18.

5 The remote access control subsystem 12 allows ISPs and Internet connected organizations easily to build content monitored Internet access for children using the power of a centralized, permit based approach. Instead of vainly trying to catch all the "bad" sites on the Internet, the ChoiceNet remote access control subsystem 12 applies the reverse logic by permitting access only to content approved "good" sites. All communications initiated by the user to 10 sites that are on the permit list are allowed, while access to all other sites is denied by default. Instead of distributing the content monitoring technology to every desktop PC and Macintosh accessing the Internet, the subsystem 12 provides a centralized way to operate content monitoring using the very communications servers and routers that users' traffic travels through to get to 15 the Internet. Finally, instead of trying to maintain an unwieldy list of deny keywords on every desktop, the subsystem 12 provides for a central, server based permit list that can be easily updated on a daily or hourly basis, and that cannot be tampered with by the end users.

In practice, the network access module 42 is provided with the server 14 20 and can be used to offer both content monitored "kid" Internet accounts as well as unrestricted "adult" accounts, which can dial into the same communications servers. The remote access subsystem 12 can also be used to provide content monitored Internet access from school LANs using routers 24, 32 and 34. All of the required software is provided with each server 14 or router 24, 32 and 34. 25 Existing servers 14 or routers 24, 32 and 34 can be updated to include remote access control capability. The remote access control is fully compatible with RAIDIUS server 16.

Further details of the remote access control subsystem 12 are provided in Figure 3. Remote user 22, a child at school or at home, uses a WWW Browser 30 and a ChoiceNet Notification Application, a Windows or Macintosh application that is installed on each PC or Macintosh accessing the Internet. This application notifies the user if a site she is attempting to access is not permitted. Disabling this notification application does not affect the functionality of the ChoiceNet network access module 42, so only the notification to the user is affected.



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The ChoiceNet network access module 42 can be applied to dedicated LAN based Internet connections such as those found at schools, as well as to dial up Internet connections from home PCs, as shown in Figure 3. Client software 44 of the module 42 can reside on a router 24, 32 or 34 (Figure 1) as well as a communications server 14. RADIUS client software 45 is also resident on the communications server 14.

When user 22 logs in through the communications server 14, the RADIUS client software 45 first determines if user 22 is authorized by checking his password through RADIUS server 16, utilizing user profiles 46. The user profiles 46 also identify a filter "F(Timmy)" in his user profile 46. After checking user 22's authorization, the RADIUS server 16 supplies the filter identification through the RADIUS client 45 along with the verification acknowledgement for the user 22 for use by client software 44 for controlling access by the user 22 to Internet sites. The client software 44 then checks to see if the filter "F(Timmy)" is stored locally in cache 50. If it is, the client software 44 uses it for controlling access. If not, the client software 44 sends a lookup request to the network access server 18, which stores the centralized permitted site list and the filters to be used as masks for checking access classifications of requested sites, to download the filter "F(Timmy)", which is maintained in the server 14 memory for the rest of the user 22's session. The client 44 also keeps the local cache 50 of recently requested sites and recently used user filters for efficiency. This list includes both sites for which access was recently permitted, such as whitehouse.gov as well as sites for which access was recently denied, such as playboy.com. When access to a site is requested, the client first checks the local cache 50 to see if the site is on the list stored there. In practice, the client software 44 and permit-based filtering technology is integrated in the communications operating system software that runs on the server 14 or routers 24, 32 or 34.

Installed on one of several supported UNIX platforms, the ChoiceNet server 18 software provides lookups of sites for the server 14 or routers 24, 32 or 34 against a list of permitted sites. The server software also automatically maintains the permit list by downloading updated versions of the list over the Internet and compiling the list for use by the client software 42. As a result of this self maintenance capability, the server 18 requires minimal administrative attention.

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Provided by a commercial or non-profit organization, a third party content monitored search index 52 is built specifically for content monitored access to the Internet and contains only links to sites that are acceptable for children. Children who are given content monitored access to the Internet use a search index as their sole search interface, barring them from finding other unacceptable sites. Many such children's search indexes are currently being released. This same third party search index 52 provides continuously updated versions of the permit list that resides on the server 18, corresponding to the site links on its search index tool.

10 In addition to the site lists, the network access control server 18 maintains a set of user filters 54 which are used to control Internet access for each user. In response to the user 22 request for access, assuming the appropriate entries are found in local cache 50, the server 14 applies the filter "F(Timmy)" 54 as a mask to the site list in the local cache to determine if the request will be granted. The server 14 looks at each filter rule found in "F(Timmy)" starting from the top. When it reaches the rule permit "PTA List", the server 14 looks into its local cache 50 to see if www.playboy.com is on the PTA List. If not, the server 14 sends a filter look-up request to the server 18. This look-up contains the list name "PTA List" and the site Timmy is trying to access (www.playboy.com). The server 18 searches list 52 and sends back the result. Based on the result, the server 14 either permits or denies access and updates its local cache 50. In the event of denial of service, the server 14 sends a denial message back to user 22, informing him that he cannot access that site.

25 In practice, the access control system and process is implemented using an extension of the Internet Protocol (IP) firewall packet filtering employed by the communications server 14 for checking whether to route or drop packets to be sent and received by the network served by the communications server 14. Firewall filters are defined as an explicit set of rules based on either permit or deny syntax. The firewall filtering of server 14 provides bidirectional 30 (input/output) packet filtering for source and destination addresses, for protocol (TCP, UDP, IP, IPX) and port (http, etc.). With an unlimited number of rules in each filter, today's filtering technology can quickly become an administrative burden due to all filters residing in each server 14 or router 24, 32 or 34 scattered throughout a network. The access control module 40 removes the administrative

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burden of filter list management by centralizing filters and filter lists in a single server 18 on the network 21.

When a request for access is made by the user for which a determination cannot be made using the local cache 50, the server 14 drops the packet making  
5 the request to allow time for access and response from the server 18. Since drops are common on the Internet, the packet making the request is retransmitted a number of times before the request times out, typically at 30 seconds or so. The source and destination addresses in the header packet are used to identify the user, allowing selection of the appropriate user filter, and to identify the site for  
10 which the user desires access. An example source address identifying a user might be:

192.168.51.50

An example destination address identifying a site requested by the user might be:

172.16.3.4

15 The server 14 uses such addresses in packet headers for making decisions on the handing of IP packets, such as for firewall security. Little additional overhead at the server is required to use these addresses for the purposes of identifying user filters and sites for determining site access in this system and process. If a particular source address represents a node that is associated with a single user  
20 who has no access restriction, then no further checking is required and no user filter need be employed. If multiple users are associated with a particular address node, then login information is used to determine which user filter should be applied for access requests.

Further details on the use of Internet IP addresses in the context of packet  
25 filtering, which are helpful for a more complete understanding of the invention, are available in Chapman, Brent, "Network (In)security Through IP Packet Filtering," 1992 UNIX Security Symposium III Proceedings, p. 63-76 and in Chapman and Zwicky, *Building Internet Firewalls*, Sebastopol, CA, O'Reilly & Associates, 1995, particularly chapter 6 and Appendix C, the disclosures of  
30 which are hereby incorporated by reference herein.

In addition to controlling access by a user to sites based on the nature of their content, the system and process of the invention can also be used, for example, by an Internet Service Provider to control access by users to certain value added services, such as a game service. When a game subscriber logs in,  
35 a user filter can be used to permit access to a game server, while allowing the

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ISP to deny access to non-subscribers. Similarly, an ISP can allow users who log in with a predetermined name, such as VIPguest, access using the system and process of this invention to certain sites of a manufacturer intended for use of its customers, such as product information and customer service sites. Figure 4 shows a network access control system 60 that is used by an ISP to provide a video game service. Subscriber 62 utilizes the ISP, but is not a subscriber to the game service. Subscriber 64 is a subscriber to the game service. Both access the ISP through communications server 66. The communications server 66 and access server 68 are connected in ISP network 70, along with an ISP video game server 72. A third party video game server 74 is accessible through the ISP network on Internet 76. The communications server 66 authorizes a requested access by subscriber 64 to the game servers 72 and 74 and denies access to those servers to subscriber 62 in the same manner as the communications server 18 in the Figures 1-3 embodiment. Other than as shown and described, the construction and operation of the Figure 4 embodiment is the same as that of the Figures 1-3 embodiment.

Figure 5 shows a network control access system 80 with which an ISP can work with a customer of the ISP, in this example an auto manufacturer, by allowing the auto manufacturer to provide Internet access software for accessing certain of its sites with a unique log in name, such as VIPguest. When the manufacturer's clients dial into network 82 and log in as VIPguest, a network access filter can be downloaded to communications server 84 from access server 86 which only permits visibility to the predefined auto dealer sites 87. In this way, the auto manufacturer can provide special sales and marketing services without any investment in their own network and dial-in numbers. The ISP can offer this service using its existing infrastructure. The ISP can use its RADIUS server 88 accounting and billing to charge the auto manufacturer for access through the network 82. Other than as shown and described, the construction and operation of the Figure 5 embodiment is the same as that of the Figures 1-4 embodiments.

It should now be readily apparent to those skilled in the art that a novel system and process for controlling network access capable of achieving the stated objects of the invention has been provided. The system and process for network access control allows customized Internet content monitoring based on a centralized permit model. The system and process is readily implemented using

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hardware that is typically present in most installations for Internet access. The system and process utilizes an extension of firewall filtering to implement the content monitoring.

5 It should further be apparent to those skilled in the art that various changes in form and details of the invention as shown and described may be made. It is intended that such changes be included within the spirit and scope of the claims appended hereto.

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**WHAT IS CLAIMED IS:**

1. A system for controlling network access, which comprises:
  - (a) a local access server having a local cache for storage of recently used user filters and sites accessible from said system for which access has been requested;
  - (b) a network access server coupled to said local access server and having storage for user filters and site lists;
  - (c) access client software resident in said local access server for using the user filters and sites for which access has been requested in said local cache for making an access determination for a site to which a user requests access and for communicating with said network access server to obtain an access determination from the user filters and site lists stored at said network access server if an access determination cannot be made from the user filters and sites stored in said local cache.
2. The system of claim 1 in which said access client software is configured to identify the sites for which access is requested from addresses in information packets requesting the accesses.
3. The system of claim 1 additionally comprising:
  - (d) a user authentication and authorization server coupled to said local access server and having storage for user profiles including user passwords and identifications of user filters for determining site access, said local access server additionally including user authentication and authorization client software resident therein, said user authentication and authorization client software being configured to communicate with said user authentication and authorization server when the user logs into said network access server and to supply user filter identifications to said access client software.
4. The system of claim 1 in which user requests for access are transmitted as Internet Protocol packets having headers with addresses and said access client software is configured to use the addresses to find a requested site in a site list for determining whether access to the request site will be granted.

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5. A process for controlling network access in a system of interconnected networks, which comprises:

- (a) defining user access filters for determining if a request by a user for access to a desired site in the system should be permitted;
- 5 (b) storing in a cache local to an access server recently used user access filters and sites accessible from said system for which access has been requested;
- (c) storing user filters and site lists at a network access server coupled to the local access server;
- (d) attempting to use the user filters and sites for which access has been  
10 requested in the local cache for making an access determination for a site to which a user requests access; and
- (e) using at least one of the user filters and site lists stored at said network access server to obtain an access determination if an access  
15 determination cannot be made from the user filters and sites stored in said local cache.

6. The process of claim 5 in which sites for which access is requested are identified from addresses in information packets requesting the accesses.

20 7. The process of claim 5 in which a user authentication and authorization server supplies user filter identifications to the access server.

8. The process of claim 5 in which user requests for access are transmitted as Internet Protocol packets having headers with addresses and the  
25 addresses are used to find a requested site in a site list for determining whether access to the request site will be granted.

9. A storage medium having stored therein a program, which when executed on a networked data processing system, will control user access to sites  
30 accessible in a network of networks by:

- (a) defining user access filters for determining if a request by a user for access to a desired site in the system should be permitted;
- (b) storing in a cache local to an access server recently used user access filters and sites accessible from said system for which access has been requested;

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(c) storing user filters and site lists at a network access server coupled to the local access server;

(d) attempting to use the user filters and sites for which access has been requested in the local cache for making an access determination for a site to  
5 which a user requests access; and

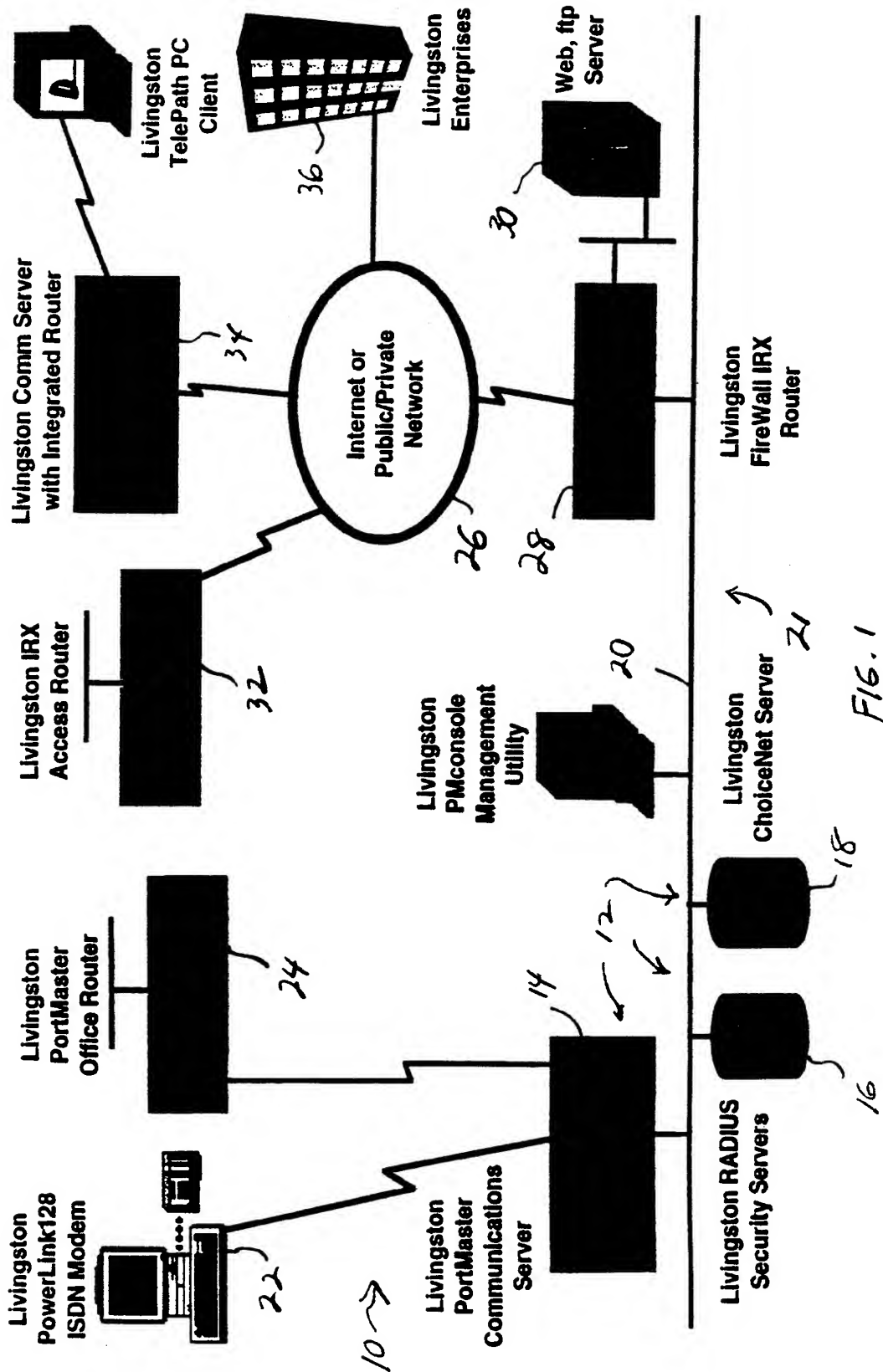
(e) using at least one of the user filters and site lists stored at said network access server to obtain an access determination if an access determination cannot be made from the user filters and sites stored in said local cache.

10. The storage medium of claim 9 in which said program is configured to identify sites for which access is requested from addresses in information packets requesting the accesses.

15 11. The storage medium of claim 9 in which said program is configured to utilize a user authentication and authorization server to supply user filter identifications to the access server.

20 12. The storage medium of claim 9 in which said program is configured to receive user requests for access as Internet Protocol packets having headers with addresses and said program is further configured to utilize the addresses to find a requested site in a site list for determining whether access to the request site will be granted.





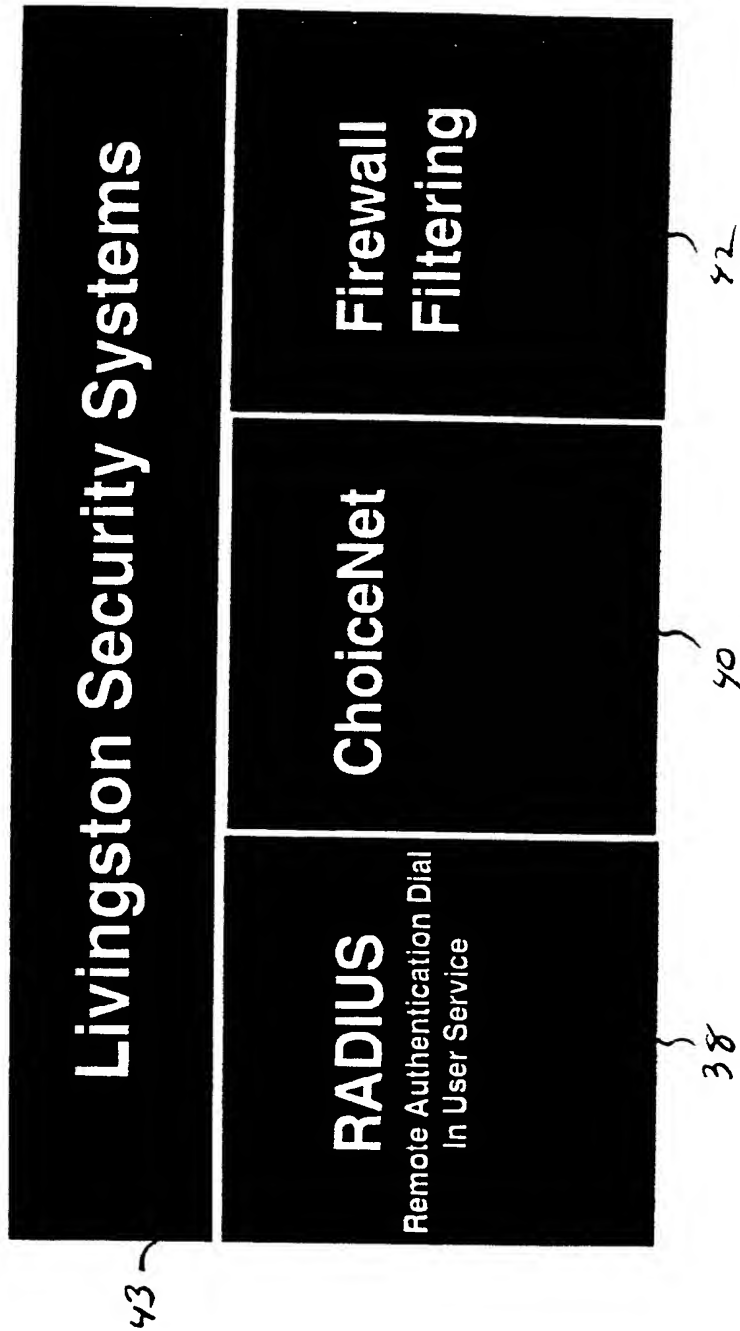


FIG. 2

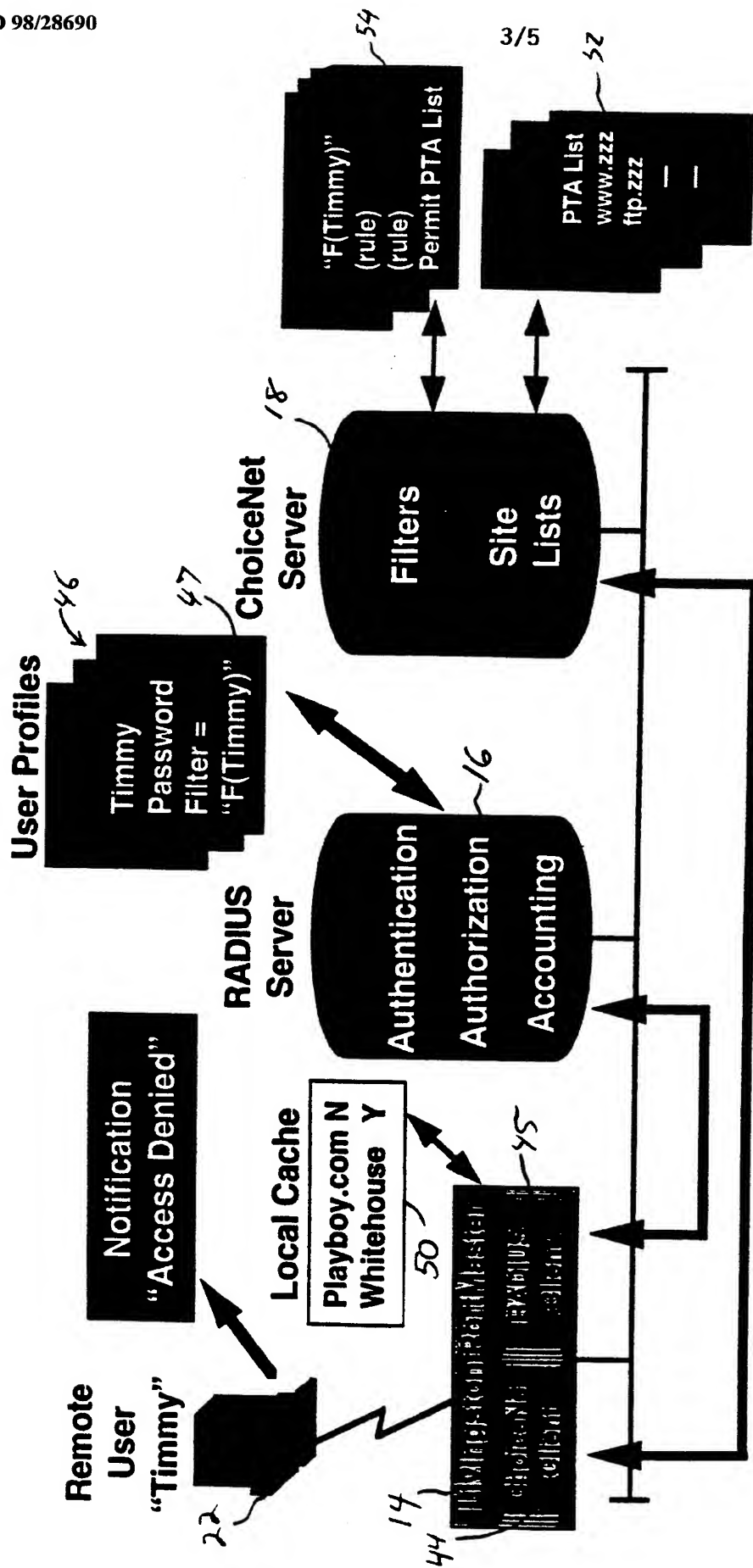
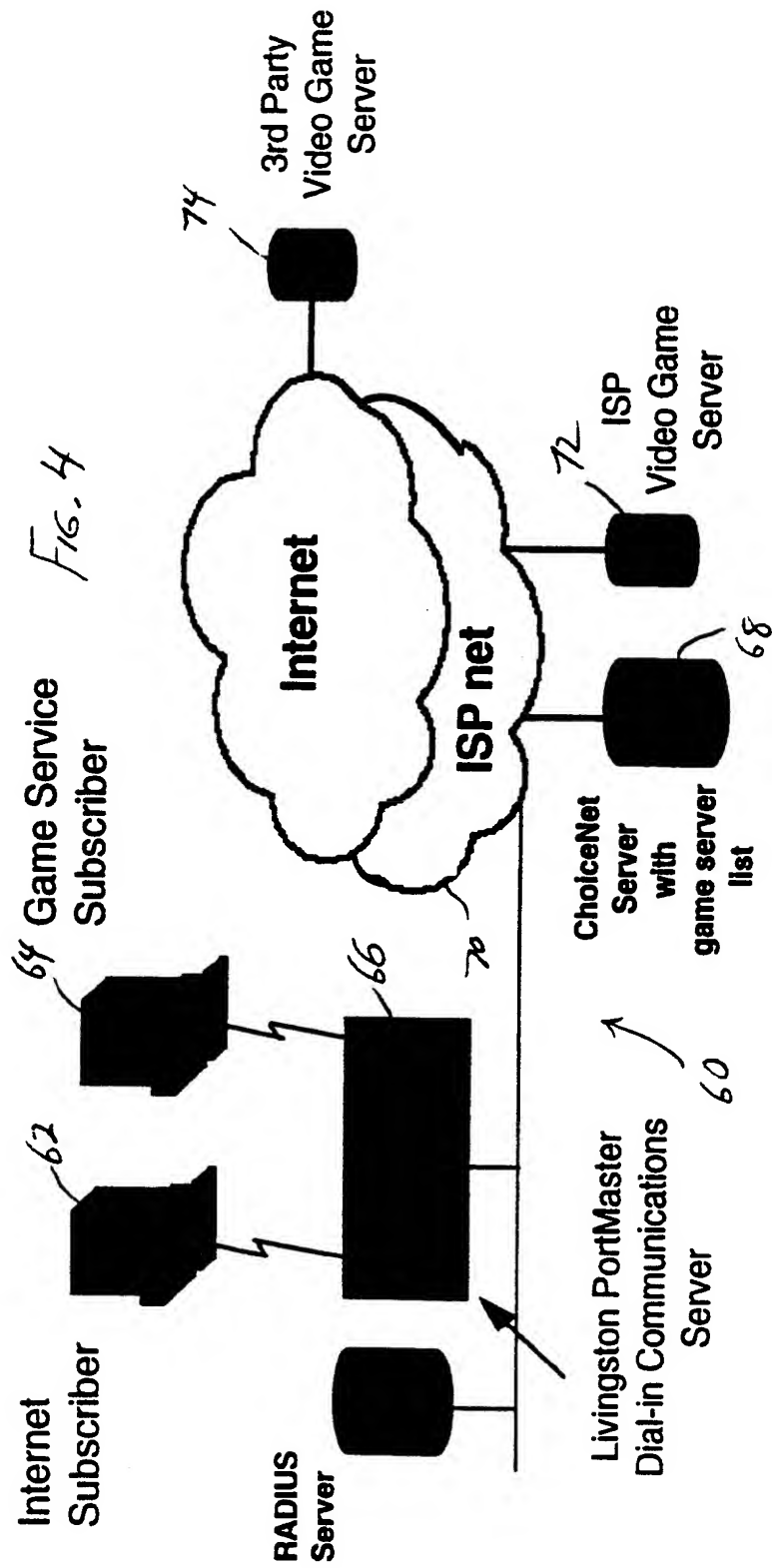


FIG. 3

# Video Game Service



# On-line Leasing

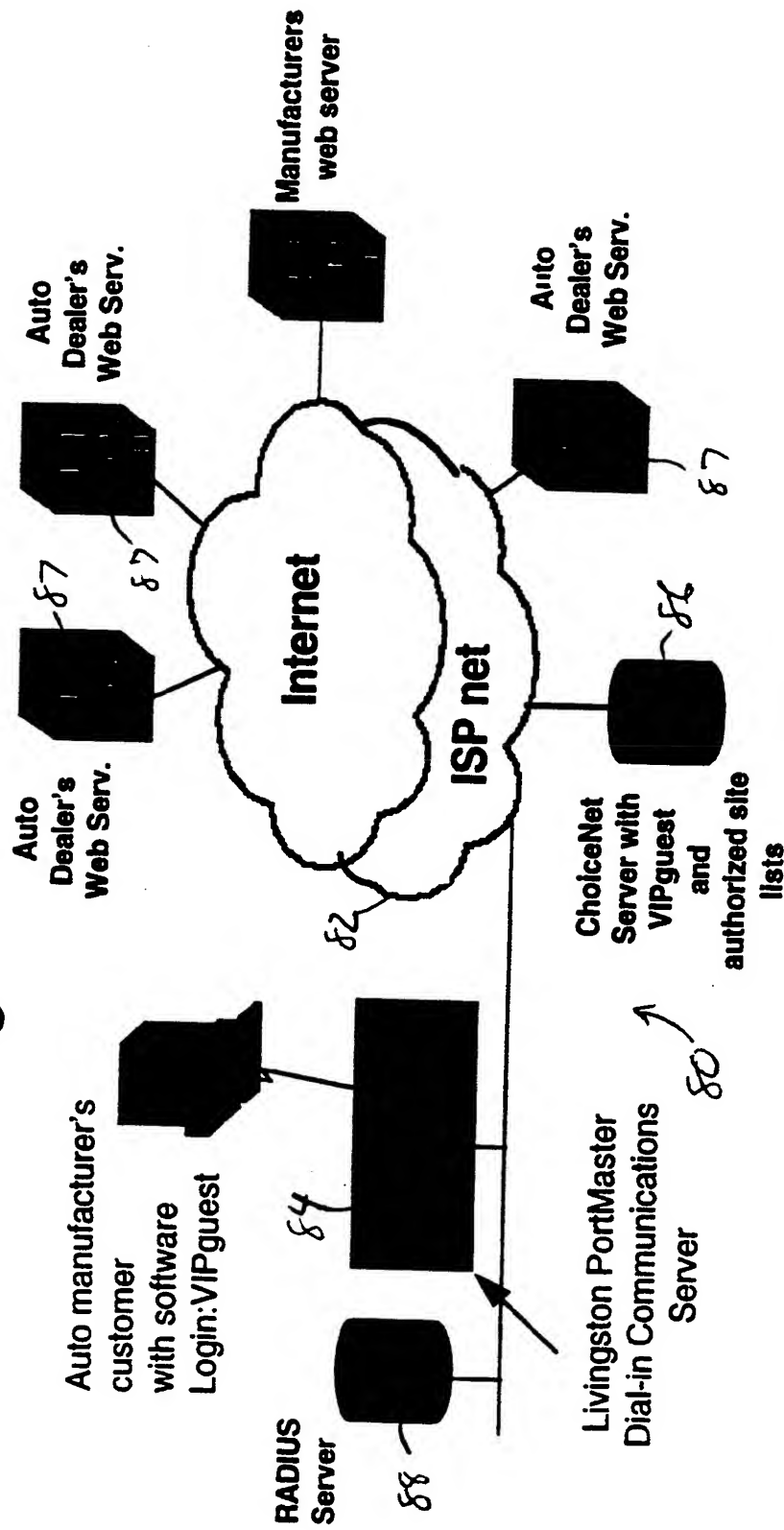


FIG. 5

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US97/23616**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) :G06F 11/00

US CL :395/187.01, 200.59

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 395/187.01, 200.59

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
APS, WWW**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| A,P       | US 5,696,898 A (BAKER ET AL.) 09 December 1997.                                    | 1-12                  |
| A,E       | US 5,708,780 A (LEVERGOOD ET AL.) 13 January 1998.                                 | 3,7,11                |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

|   |  |
|---|--|
| * Special categories of cited documents:  | *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  |
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| *B* earlier document published on or after the international filing date  | *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | *G* document member of the same patent family  |
| *O* document referring to an oral disclosure, use, exhibition or other means  |  |
| *P* document published prior to the international filing date but later than the priority date claimed  |  |

Date of the actual completion of the international search

02 APRIL 1998

Date of mailing of the international search report

14 MAY 1998

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